

Radiation Darkening of Icy Surfaces

P. D. Wilson (LPS, Cornell)

Many objects in the outer Solar System—asteroids, comets, many satellites, the Uranian ring system—are rich in organic matter, giving them a reddish to dark-grey color. This material could have been either accreted directly from the solar nebula or produced *in situ* later from simple hydrocarbons. The post-accretionary chemistry is driven by numerous sources of irradiation: solar uv photons, solar wind charged particles, charged particles trapped in planetary magnetospheres, decay of radionuclides, and cosmic rays. At increasing doses an initially bright, hydrocarbon ice-rich surface reddens then darkens to a nearly grey color.

Although several researchers have reported on the degree of processing experienced by icy surfaces from irradiation [1,2], numerical errors caused major overestimates in their conclusions. Also, static surfaces were generally assumed. Impacts from dust and larger particles will churn and erode the regolith, so it is not a simple matter to calculate the degree of processing of an exposed surface.

In a recent analysis of Iapetus, the effects of both radiation and impacts were taken into account to estimate the rate of organic matter production on/near its surface [3]. This is generalized and adapted to planetesimals in the outer Solar System: comets and Kuiper Belt objects. Cosmic rays are incapable of producing anything like the 10 m radiation crust as previously hypothesized [1,2], but under the right circumstances a very thin crust only a few millimeters thick may be produced on astronomically short timescales under the combined influence of solar radiation and light surface gardening. This does not change our conclusion that radiation darkening is not an effective process on Iapetus [3].

References: [1] Strazzulla, *Icarus* **67**, 63–70, 1986. [2] Thompson *et al.*, *J. Geophys. Res.* **92**, 14933–14947, 1987. [3] Wilson and Sagan, *Icarus* **122**, 92–106, 1996.

Abstract submitted for 1996 DPS meeting

Date submitted: LPI electronic form version 5/96

Division for Planetary Sciences Abstract Form

DPS Category 23

Running #7409

Session 0.00

Invited ☐ Poster presentation ☒ Title only ☐

Have you received your Ph.D. since the last DPS meeting?

Yes ☐ No ☒

Is your abstract newsworthy, and if so, would you be willing to prepare a news release and be available for interviews with reporters?

Yes ☐ No ☐ Maybe ☐

Paper presented by Peter D. Wilson

408 Space Sciences Building
Cornell University

Ithaca NY 14853-6801 United States

Phone: 607-255-6307

Fax: 607-255-9888

Email: wilson@astrosun.tn.cornell.edu

Special instructions: Tue Aug 27 15:38:19 CDT 1996

Membership Status (First Author):

DPS-AAS Member ☐ Non-Member ☐

Student Member ☒ Student Non-Member ☐

Is this your first DPS presentation? Yes ☐ No ☐

Sponsor: